

# Validation of a coupling methodology for numerical modelling of near and far field effects of Wave Energy Converter arrays using the MILDwave and NEMOH models, based on the WECwakes experimental database

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Wave energy is a promising resource for the renewable energy sector. However, in order to be able to produce large amounts of electricity at a reasonable cost, large farms of Wave Energy Converters (WECs) will have to be deployed in the ocean. Due to the hydrodynamic interactions between the WECs, the surrounding wave field will be affected, both close to the WECs (near field effects) and at large distances from their location (far field effects). However, the accurate simulation of both near and far field effects at a reasonable computational cost using a single numerical model is still a challenge.

In the past years, a one way coupling methodology has been developed to combine the advantages of a wave structure interaction solver (e.g. NEMOH [1], used for the near field effects) and a wave propagation model (e.g. MILDwave [2,3], used for the far field effects). NEMOH is a Boundary Element Method (BEM) that can accurately model the hydrodynamic interactions of the WECs by solving the body motions. MILDwave is a mild-slope wave propagation model that can solve wave transformations in large domains. The coupling methodology consists of the superposition of two different wave field simulations: an incident wave field and a radiated/diffracted wave field. The incident wave field is calculated intrinsically in MILDwave. The diffracted/radiated wave field is calculated around the array in NEMOH and then propagated in MILDwave by imposing it on a wave generation boundary along a circle.

One of the key factors when developing a new numerical methodology or tool is to validate it against available experimental data. For this purpose, the model has been validated using experimental data available from the WECwakes project [4]. In this project, arrays of up to 25 heaving point absorber WECs have been tested in the DHI wave basin using different geometric WEC array configurations. By testing the different WEC array configurations under a wide range of sea states a large experimental dataset has been generated and is publicly available for numerical validation purposes.

In the present research, numerical results are presented for different WEC array configurations from WECwakes (e.g. starting from 1 WEC and up to 5 and 9 under a set of regular wave conditions). Firstly, the experimental wave field around the WECs has been compared to numerical results from NEMOH, in order to assess the accuracy of modelling the wave field around the WEC. Then, the coupled numerical model has been run for the different cases and compared to the experimental data in order to validate the model. A good agreement has been found between the experiments and the numerical results from the coupling methodology.

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# BOOK OF ABSTRACTS



# **BOOK OF ABSTRACTS**

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# PREFACE

This is the 'Book of Abstracts' of the 18th edition of the VLIZ Marine Science Day, a one-day event that was organised on 21 March 2018 in the MEC Staf Versluys in Bredene.

This annual event has become more and more successful over the years. With almost 400 participants and more than 100 scientific contributions, it is fair to say that it is the place to be for Flemish marine researchers and for the end-users of their research. It is an important networking opportunity, where scientists can meet and interact with their peers, learn from each other, build their personal professional network and establish links for collaborative and interdisciplinary research.

Marine scientists from all Flemish universities and scientific institutes – and representing all marine science disciplines – have contributed to this volume. The book thus illustrates the diversity, quality and relevance of the marine sciences in Flanders (and Belgium): it provides a beautiful and comprehensive snapshot of the state-of-the-art of marine scientific research in Flanders.

Pre-doc and post-doc scientists present their research in an exciting way and communicate their fascinating science – and its importance to society – to the wider public. We thus hope to demonstrate the excellence of Flemish marine science and to increase its national and international visibility.

The volume of research that is presented here holds a great promise for the future. It shows that marine science is a very lively discipline in Flanders, and that a new generation stands ready to address the grand challenges and opportunities that our seas and oceans represent.

For the second year, the Brilliant Marine Research Ideas are awarded, an initiative sponsored through the philanthropy scheme of VLIZ. We are proud to announce that last year's winners present their results here at the VLIZ Marine Science Day.

I want to congratulate all participants with their contributions, and I invite them all to become members of VLIZ and to actively participate in our events and activities in the future.

Bredene, 21 March 2018

Prof. Dr Jan Mees

General Director VLIZ

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